



FishVis

A web-based decision support mapper for understanding the response of fish species and stream temperature to climate change in the Great Lakes region

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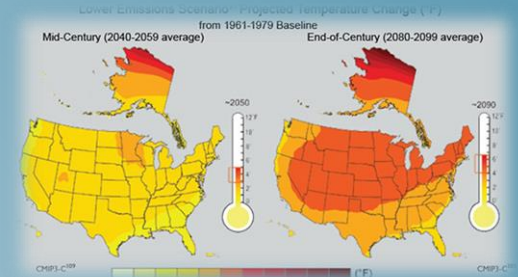
Kevin Wehrly

MI Institute of Fisheries Research

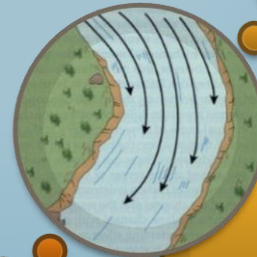
Lizhu Wang

International Joint Commission

Understanding and Planning for Climate Change



Climate change



Stream temperature



Fish

What will this mean for streams and their fisheries?

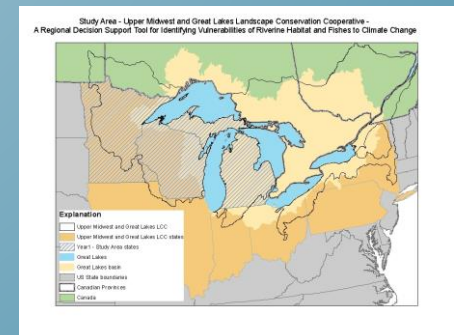
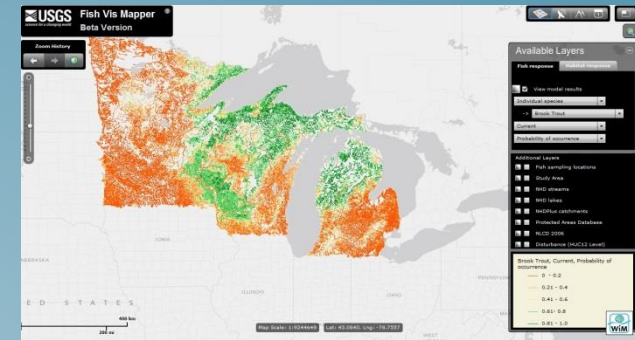


?? or ??



What is FishVis?

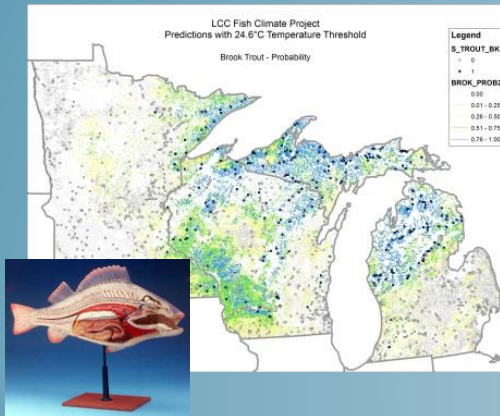
- **Web-based decision support mapper**
- **Visualize potential climate driven responses for thermally representative fish species**
- **Tool for use by managers and scientists in understanding and decision making**
- **Display, Navigate, View, Interrogate, Download results of Fish Climate Vulnerability analysis**
- **Uses ArcServer and Web services**
- **No downloads required**



View Results in FishVis

Time Periods

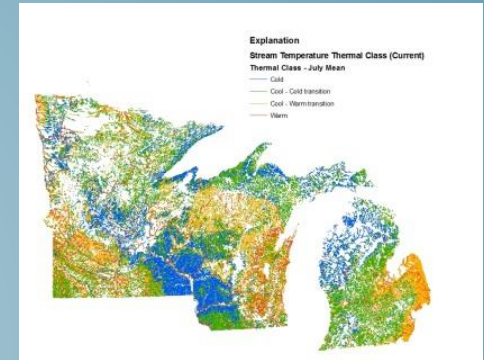
- Current
- 2046 – 2065
- 2081 - 2100



Predicted distributions
for 14 fish species



13 future climate predictions



Predicted thermal
classes for streams



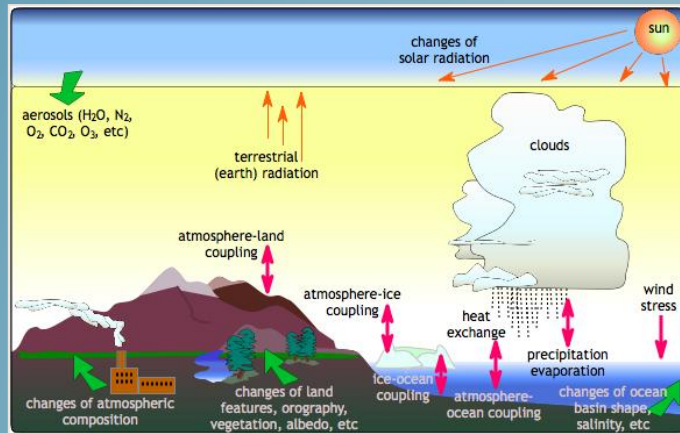
Download the results for
planning



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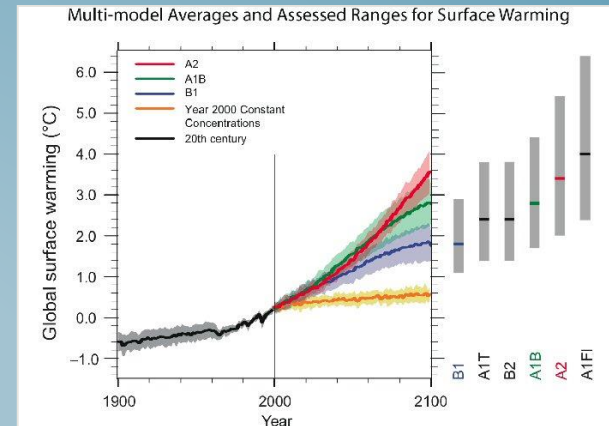
FISHVIS – Climate Inputs

13 Global Climate Models



http://en.wikipedia.org/wiki/File:Global_Climate_Model.png

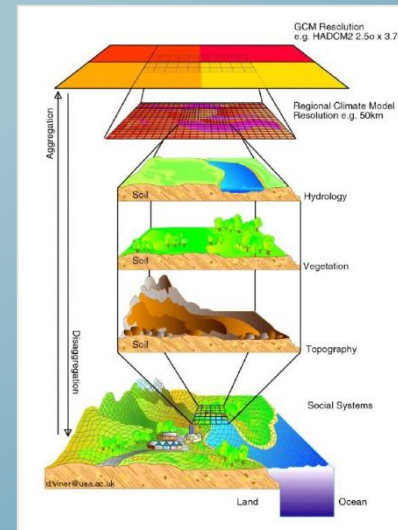
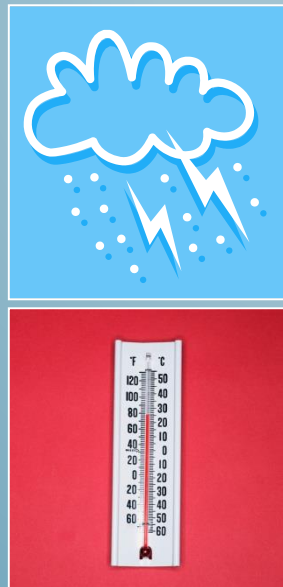
1 Emissions Scenario (A1B)



<http://www.narccap.ucar.edu/about/emissions.html>

Output:
Air temperature &
precipitation (attributed
to NHDPlus)

- 13 GCMS
- time periods
 - Current
 - 2046 – 2065
 - 2081 – 2100



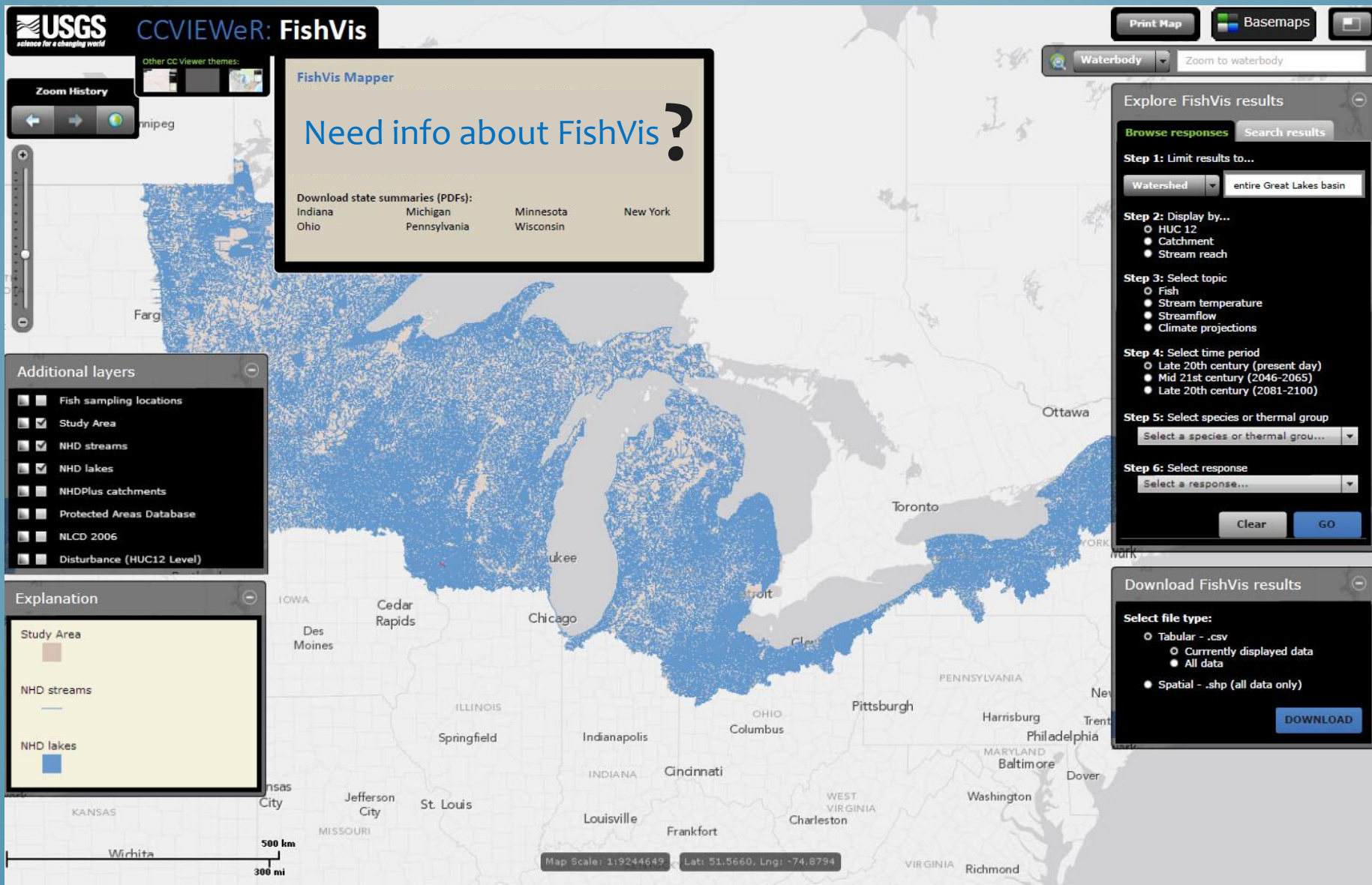
Statistically
downscaled
from 300 km
to 10 km grids

(UW Madison – Center for Climatic Research – Dan Vimont and others)

INTRODUCING



Fish Vis Mapper
Beta Version



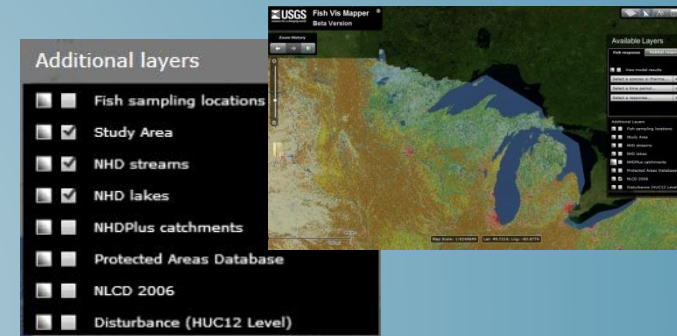
FishVis the Basics



Basemaps: Change basemaps

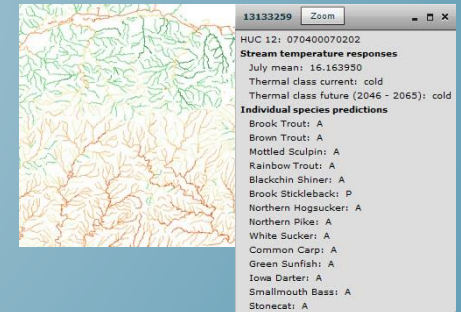


Available Layers: Turn on and off layers



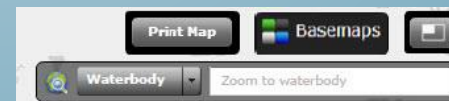
Navigation: Zoom – pan

Pop-Ups: Click on point - get results for stream reach

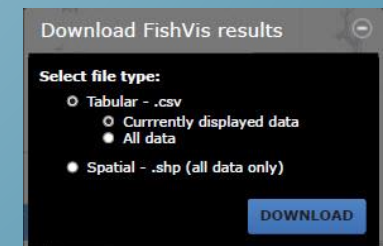


Search : type place name; searches basemap

Print : print a map of your results



Download: download results (tabular or shapefile)





- Pre-set maps
- Binned results

Explore FishVis results

Browse responses Search results

Step 1: Limit results to...

Watershed

Step 2: Display by...

- ☐ HUC 12
- ☒ Catchment
- ☒ Stream reach

Step 3: Select topic

- ☐ Fish
- ☒ Stream temperature
- ☒ Streamflow
- ☒ Climate projections

Step 4: Select time period

- ☐ Late 20th century (present day)
- ☒ Mid 21st century (2046-2065)
- ☒ Late 20th century (2081-2100)

Step 5: Select species or thermal group

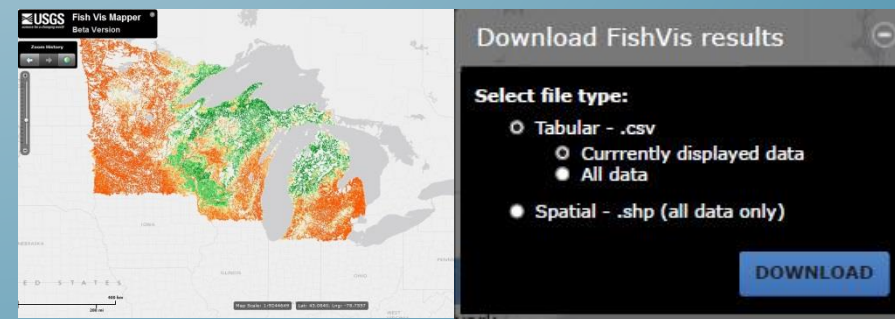
Select a species or thermal grou...

Step 6: Select response

Select a response...

Clear GO

1. Choose your spatial extent
2. Choose your display unit
3. Select your topic
4. Select your time period
5. Select your species or thermal group
6. Select your response
7. FishVis will map your results



Choose Your Response

Fish Response (14 species)

- Occurrence
- Probability
- Vulnerability
- Opportunity
- Species Lost/Gained

Example:

CHOOSE A SPECIES > Brook Trout

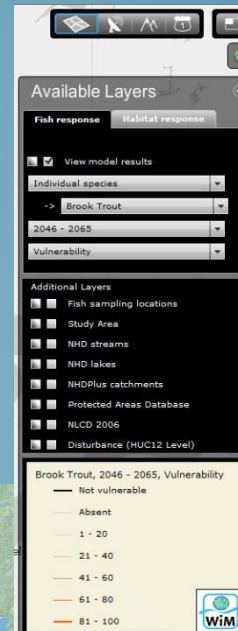
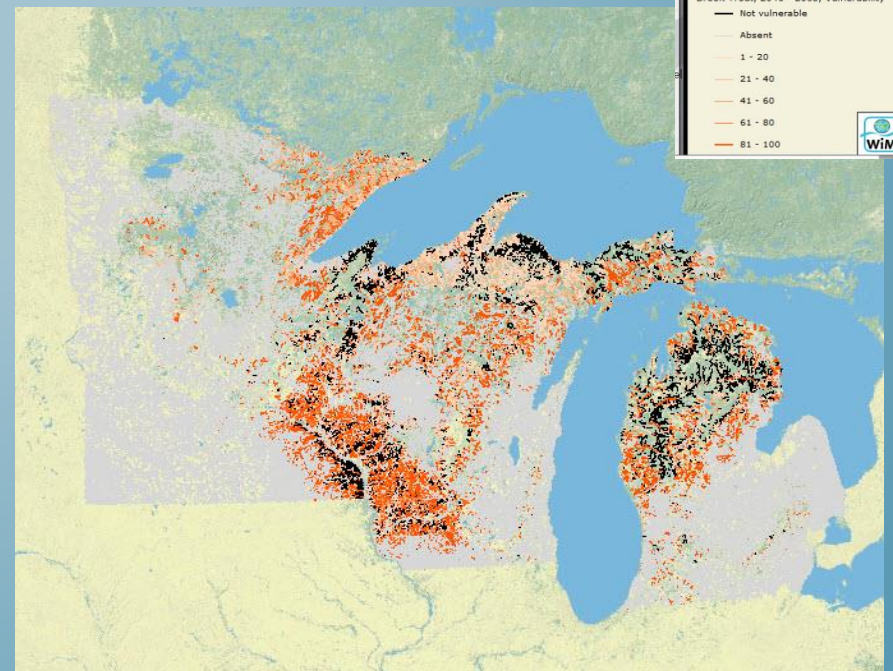
TIME PERIOD > 2046 - 2065

Response > **Vulnerability**



Choose Your Time Period

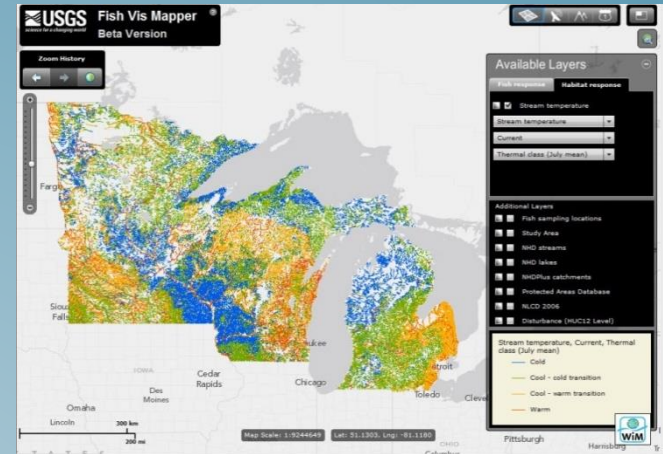
- Current
- 2046 – 2065
- 2081 - 2100



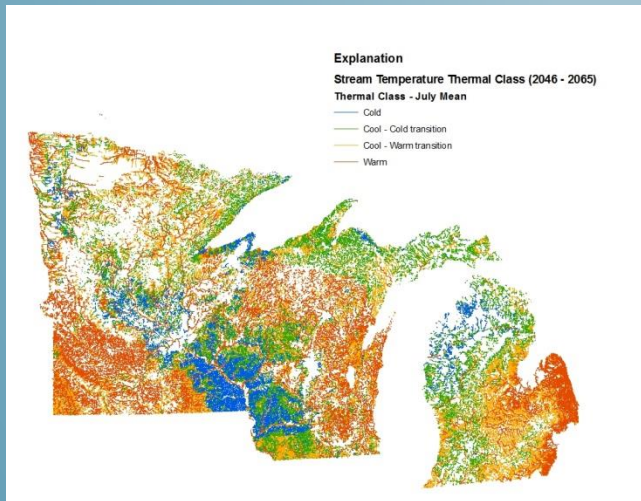
HABITAT RESPONSE

Stream temperature Flow exceedance Climate

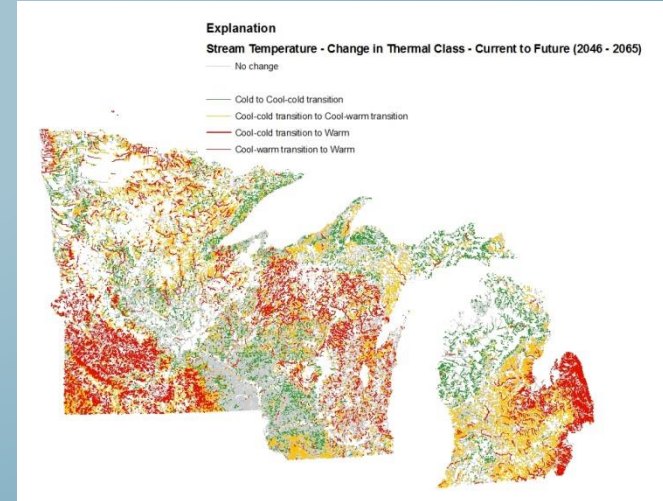
- Air temperature
- Precipitation



Habitat Metric > Stream Temperature
TIME PERIOD > **Current**
Response > **Thermal Class (July Mean)**



Habitat Metric > Stream Temperature
TIME PERIOD > **Future (2046 – 2065)**
Response > **Thermal Class (July Mean)**



Habitat Metric > Stream Temperature
TIME PERIOD > **Future (2046 – 2065)**
Response > **Thermal Class Change**

FishVis functionality



Explore FishVis data

Browse responses Search data

Select stream reaches in...

State Wisconsin

Late 20th Century (present day)

Landcover = Protected L

and Species = Stonecat

Presence/a = Present

Mid 21st Century (2046-2065)

Species = Stonecat

Probability > 75 percent

or Stream tem = Cold transit

Late 21st Century (2081-2100)

Species = Stonecat

Probability > 50 percent

Clear GO

SEARCH data • Customize your search

- Returns all records that meet your criteria
- Select spatial mapping unit
- Select spatial extent
- Enter criteria
- FishVis will map your results

Download FishVis results

Select file type:

☐ Tabular - .csv

- ☐ Currently displayed data
- ☒ All data

☒ Spatial - .shp (all data only)

DOWNLOAD

FishVis Popup summaries



Click on stream reach and View information popup

HUC: 16020301

Stream temperature responsesFish summaryFish species responsesStreamflowClimate projectionsClimate models

Sugar River

Reach COMID: 13424689
Dane County, Wisconsin
Stream length: 3.6 miles
Catchment area: 12.2 square miles

HUC 12: 070900040202

All fish species: Statistics include all 14 modeled fish species

	Current	Future 1 (2046-2065)	Future 2 (2081-2100)
Number of species present	9	10	7
Number of species lost	--	-1	-3
Number of species gained	--	+2	
Number of species lost or gained	--	3	
Percent of species lost	--	-11%	
Percent of species gained	--	+22%	

Cold water species: Fish species that prefer stream temps between X and X °C (Brook T

	Current	Future 1 (2046-2065)	F (20
Predicted occurrence		•	
Sensitivity	--	42%	
Vulnerability	--	69%	
Opportunity	--	22%	

Cool water species: Fish species that prefer stream temps between X and X °C (xxx).

	Current	Future 1 (2046-2065)	F (20
Predicted occurrence	•	•	

DOWNLOAD

HUC: 16020301

Stream temperature responsesFish summaryFish species responsesStreamflowClimate projectionsClimate models

Sugar River

Reach COMID: 13424689
Dane County, Wisconsin
Stream length: 3.6 miles
Catchment area: 12.2 square miles

HUC 12: 070900040202

BACK TO ALL SPECIES

Brook Trout: cold-water species

	Current	Future 1 (2046-2065)	Future 2 (2066-2080)
Predicted occurrence	•	•	
Probability of occurrence	82%	63%	12%
Sensitivity	--	42%	73%
Vulnerability	--	69%	85%
Opportunity			

HUC: 16020301

HUC: 16020301

Stream temperature responsesFish summaryFish species responsesStreamflowClimate projectionsClimate models

Sugar River

Reach COMID: 13424689
Dane County, Wisconsin
Stream length: 3.6 miles
Catchment area: 12.2 square miles

HUC 12: 070900040202

Select: Predicted occurrence

Predicted Occurrence: Shows if an individual fish species is likely to be present (over 80% of the models agree)

Fish Species	Fish Temperature Class	Currently Present	Predicted occurrence	
			Present in Future 1 (2046-2065)	Present in Future 2 (2081-2100)
Brook Trout	Cold	•	•	
Brown Trout	Cold	•		
Mottled Sculpin	Cold	•	•	
Rainbow Trout	Cold			
Blackchin Shiner	Cool			
Brook Stickleback	Cool	•	•	
Northern Hopsucker	Cool			
Northern Pike	Cool			
White Sucker	Warm			
Common Carp	Warm		•	•
Green Sunfish	Warm	•	•	•
Iowa Darter	Warm		•	
Smallmouth Bass	Warm			•
Stoneroller	Warm			•

Summary Tables

Stream Temperature

Stream Flow Exceedance

Fish Species Response

Fish Species Loss and Gain

Climate projections

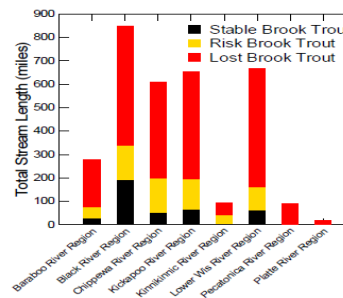
Driftless Area Master Planning (Cunningham, WDNR)

REPORT CARD

			Watersheds													
			Alex Branch - Peconica River	Blue Mounts Branch	Dodge Branch	East Branch Peconica River	Headwaters Peconica River	Headwaters Sugar River	Honey Creek - Peconica River	Little Sugar River	Mineral Point Branch	Ridgeway Branch - E.B. Peconica	Spufford Creek - Peconica River	Story Creek Sugar River	West Branch Sugar River	Yellowstone River
Brook Trout	Stream Health and Habitat Quality	Natural Habitat Potential	F	F	F	F	F	C	F	F	F	F	F	C	D	F
		Land Use Stress	F	F	F	F	D	F	F	F	F	D	F	F	F	F
	Sport Fishery Performance	Stock (5" up to 8")	F	F	F	F	F	F	F	F	C	F	F	C	D	F
		Quality (8" up to 12")	F	F	F	F	F	F	F	F	C	F	F	C	C	F
Brown Trout		Memorable (12" +)	F	F	F	F	F	F	F	F	B	F	F	D	F	F
	Projected resilience to climate change		D	D	D	D	D	D	D	D	D	D	D	D	D	D
	Stream Health and Habitat Quality	Natural Habitat Potential	B	A	A	B	D	A	D	B	A	A	D	D	A	A
		Land Use Stress	F	B	F	D	F	F	D	D	F	B	F	D	D	D
Smallmouth Bass		Stock (6" up to 10")	F	B	C	D	D	C	D	C	C	D	B	D	A	C
		Quality (10" up to 15")	F	B	D	C	C	B	D	D	C	B	C	F	A	B
		Memorable (15" +)	F	B	F	F	F	A	F	F	F	F	F	B	B	F
	Projected gain from climate change		D	C	D	B	D	D	C	B	C	C	D	C	C	D
Trout Stream Habitat	Stream Health and Habitat Quality	Natural Habitat Potential	B	D	F	B	C	D	A	C	C	C	B	C	D	C
		Land Use Stress	B	F	B	D	C	C	F	F	D	F	D	B	D	B
	Sport Fishery Performance	Stock (8" up to 14")	F	F	F	F	F	B	F	D	D	A	F	F	A	B
		Memorable (14" +)	F	F	F	F	F	F	F	D	A	F	F	A	F	F
Recreation	Projected gain from climate change		A	B	A	A	A	A	A	A	B	A	B	A	D	B
	Thermal stability of trout streams		B	D	D	C	C	D	A	D	C	D	D	C	D	A
	Total miles of trout stream restoration		F	A	B	F	F	F	F	F	F	F	D	F	A	D
	Angling opportunities	Percent of trout stream miles with public access	B	C	A	D	D	C	F	C	D	B	D	A	B	A
		Percent of smallmouth bass stream miles with public access	C	F	A	F	D	F	D	A	F	D	F	B	F	F
	Supply relative to demand	Miles of publicly-accessible trout and SMB streams per 100K people within a 1-hour drive	C	C	C	D	D	D	D	C	D	C	D	C	B	C
			C	C	C	D	D	D	D	C	D	C	D	C	B	C
			C	C	C	D	D	D	D	C	D	C	D	C	B	C

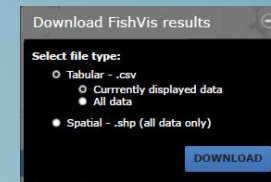


Figure 2.29: Climate effects on brook trout distribution (2046 – 2065).



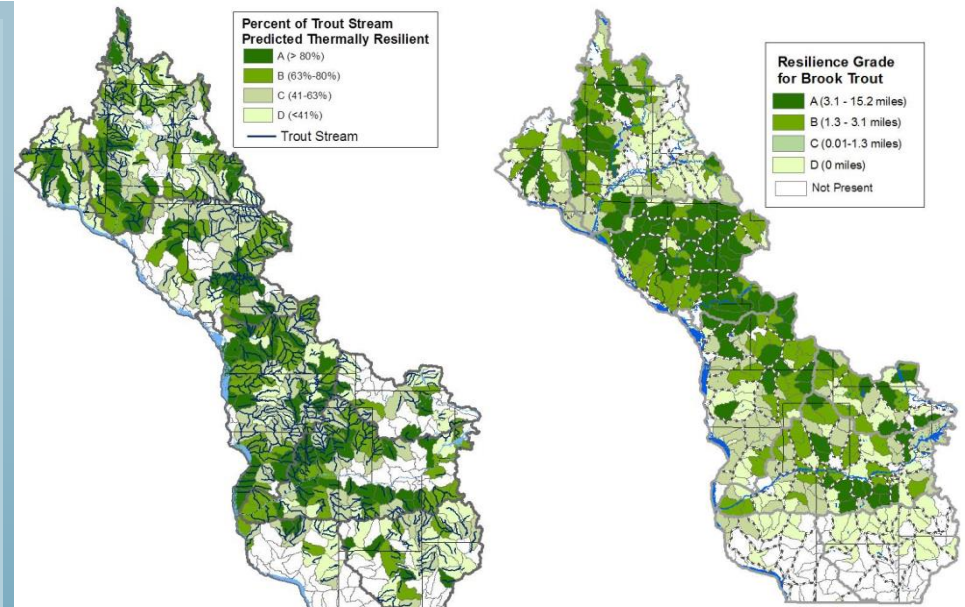
View and query results in FishVis

Future - Download results



Use information for planning

- Stream Health and Habitat Quality
- Sport Fishery Performance
- Thermal Resilience of trout streams
- Response of trout & small mouth bass to Climate Warming
- Public Access for trout & SMB angling
- Stream restoration work



FISHVIS

<http://wim.usgs.gov/FishVisMapper/FishVis.html>



Stakeholders meeting planned for November 2013 – stay tuned

